MAYNARD SUPPLY COMPANY
145 POWDERMILL ROAD
MAYNARD, MASS. 01754

# PRACTICAL APPLICATIONS OF LIGHTING

# INDEX

## PRACTICAL APPLICATIONS OF LIGHTING


Page

OFFICE . . . . . 1
- General Lighting . . . . . 1
- Visual Comfort . . . . . 2
- Shielding Media . . . . . 3
- Veiling Reflections . . . . . 3

CONFERENCE ROOMS/LOBBIES/ PRIVATE OFFICES . . . . . 4
- Recessed Downlights . . . . . 4
- Energy Dollar Savings with ER Lamps through 2,000-Hour Life . . . . . 5
- Wall Washing . . . . . 5
- Color . . . . . 5

SPECIAL APPLICATIONS . . . . . 6
- CRT Displays . . . . . 6

INDUSTRIAL . . . . . 7
- Energy-Efficient Lighting Applications . . . . . 7

AREA . . . . . 9
- Parking Lot Design . . . . . 9

STORE . . . . . 10
- General Lighting . . . . . 10
- Accent Lighting . . . . . 11

# OFFICE

| LIGHT LEVEL RECOMMENDATIONS* | |
|---|---|
| Reading handwriting in ink | 70 FC |
| Accounting, bookkeeping | 100 FC |
| Rough layout drafting | 100 FC |
| Drafting (detailed) | 150 FC |

## GENERAL LIGHTING

### I *Lamp Change Only*

- ☐ Building under 5 years old
- ☐ Standard lamps in use
- ☐ Energy rate under 6¢
- ☐ Fixtures are OK

### *Four-Lamp Enclosed Troffer*

| Lamp | %Light Output | Input Watts** | Benefits |
|---|---|---|---|
| F40CW | 100 | 181 | None, replace |
| F40LW/RS/WMII | 92 | 159 | Energy savings, minimum light loss |
| F40SP35/RS/WM*** | 91 | 159 | Energy savings, good color |
| F40SP35/RS/MM | 103 | 186 | More light, good color |

### *Three-Lamp Enclosed Troffer*

| Lamp | %Light Output | Input Watts | Benefits |
|---|---|---|---|
| F40CW | 100 | 136 | None, replace |
| F40LW/RS/WMII | 92 | 119 | Energy savings, minimum light loss |
| F40SP35/RS/WM | 91 | 119 | Energy savings, good color |
| F40SP35/MM | 105 | 140 | More light, good color |

* Avg. maintained
** Standard ballast
*** See Color section

## II *Lamp and Ballast Replacement*

- ☐ Building 10 years+ old
- ☐ Energy rate 6¢+
- ☐ Annual burning hours 3500 hrs.+
- ☐ Fixtures are OK

### *Four-Lamp Enclosed Troffer*

| Lamp/Ballast | %Light Output | Input Watts | Benefits |
|---|---|---|---|
| F40CW/STD | 100 | 181 | None, replace |
| F40LW/RS/ WMII/Optimiser | 92 | 116 | Low operating costs |
| FE40LW/WM/ Electronic | 92 | 117 | Low operating costs, highest efficiency |
| FE40LW/MM/ Electronic | 103 | 134 | Higher light levels, higher efficiency |

### *Three-Lamp Parabolic Troffer*

| Lamp/Ballast | %Light Output | Input Watts | Benefits |
|---|---|---|---|
| F40CW/STD | 100 | 149 | None, replace |
| F40LW/RS/WM/ WMBAL | 89 | 109 | Energy savings, minimum light loss |
| FE40LW/WM/ ELEC | 96 | 95 | High Efficiency |
| FE40LW/MM/ ELEC | 110 | 111 | Minimum light loss, high efficiency |

## III *Fixture Replacement*

- ☐ Fixture condition
  - Lens (broken or discolored)
  - Sockets
- ☐ Task has changed
- ☐ Inefficiency
- ☐ Maintainability
- ☐ Visual comfort

## VISUAL COMFORT

The various lenses, louvers and other shielding materials used in direct (downward) lighting fixtures are generally designed to redirect light from the high angle glare zone down toward the work surfaces. See the table for visual comfort and efficiency performance characteristics of various shielding material.

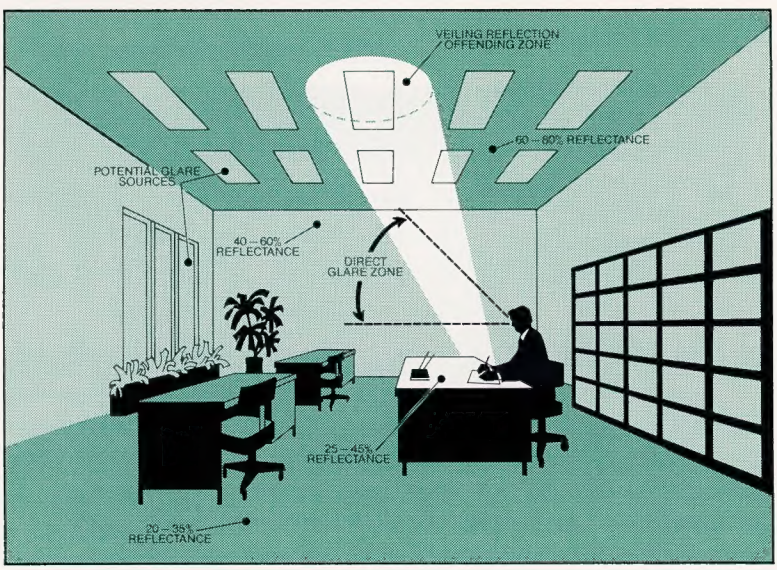
## SHIELDING MEDIA

### Comparison of Lighting Characteristics for Typical 2-Ft. x 4-Ft. Troffer Luminaires

| Shielding Material | VCP Range | VCP in 60x60 Room | Shielding Material | Efficiency Range (%) |
|---|---|---|---|---|
| Parabolic Louver | 99 | 99 | Clear Lens | 45-70 |
| Dark Metal Louver | 70-90 | 70-90 | Polarizer | 55-60 |
| Deep Cell Parabolic Louver | 70-85 | 75 | Deep Cell Parabolic Louver | 45-60 |
| Toned Lens | 65-95 | 70-85 | Diffuser | 40-60 |
| White Metal Louver | 65-85 | 70 | Plastic Louver | 45-55 |
| Polarizer | 60-70 | 65 | White Metal Louver | 35-45 |
| Clear Lens | 50-85 | 60-80 | Parabolic Louver | 35-45 |
| Plastic Louver | 50-70 | 60 | Toned Lens | 30-65 |
| Diffuser | 40-50 | 45 | Dark Metal Louver | 25-40 |

## VEILING REFLECTIONS

When the image of a lighting fixture, window, or other bright surface is reflected off a page of printed or written material, the contrast is reduced and the material becomes harder to see. To identify a fixture that might be causing the problem, place a small pocket mirror at the task location. A person viewing the mirror from the normal working position will see any bright areas that contribute to the glare.



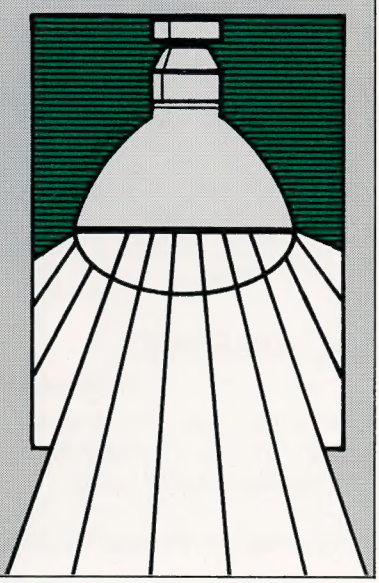
# CONFERENCE ROOMS/LOBBIES/ PRIVATE OFFICES

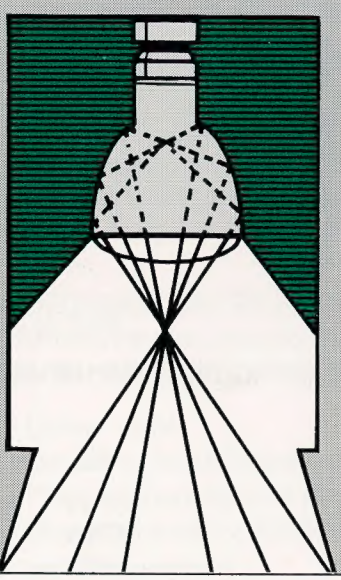
| LIGHT LEVEL RECOMMENDATIONS | |
|---|---|
| Conference Rooms | 30 FC |
| Lobbies | 30 FC |
| Private Offices | 75 FC |

## RECESSED DOWNLIGHTS

GE Elliptical Reflector (ER) lamps give equal or more light than standard reflector or A-Line lamps.

A reflector flood lamp projects a divergent cone of light. As much as 60% can be trapped inside the fixture.

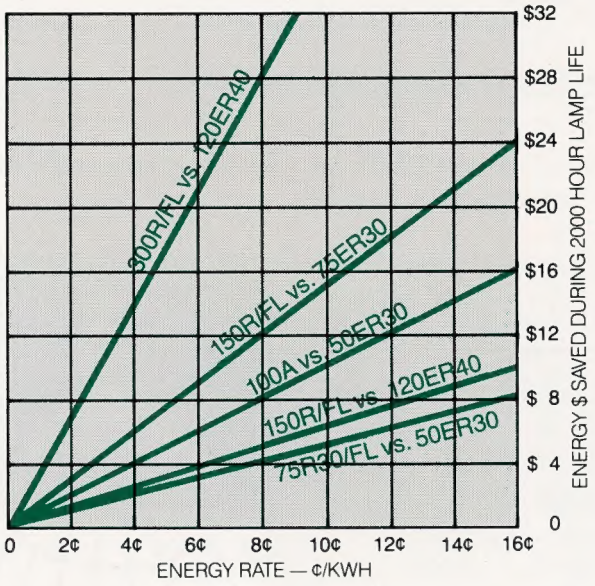




The ER beam focuses two inches ahead of the lamp, then spreads out. Very little light is trapped inside the fixture.

## ENERGY DOLLAR SAVINGS WITH ER LAMPS THROUGH 2,000-HOUR LIFE

1. Circle your energy rate on the bottom of the chart.
2. Select the sloping colored line for the lamp type being replaced.
3. Come up the chart until you touch the selected colored line.
4. Read your savings per lamp on the right.




## WALL WASHING

Adding wall wash and focal point lighting to task lighting is helpful in maintaining a *comfortable brightness balance* and *interesting surrounding.*

GE Low Voltage Precise™ Lamps produce:

- ☐ Accurate beam control
- ☐ Whiter light
- ☐ Longer life
- ☐ Greater efficiency over PAR/R types

## COLOR

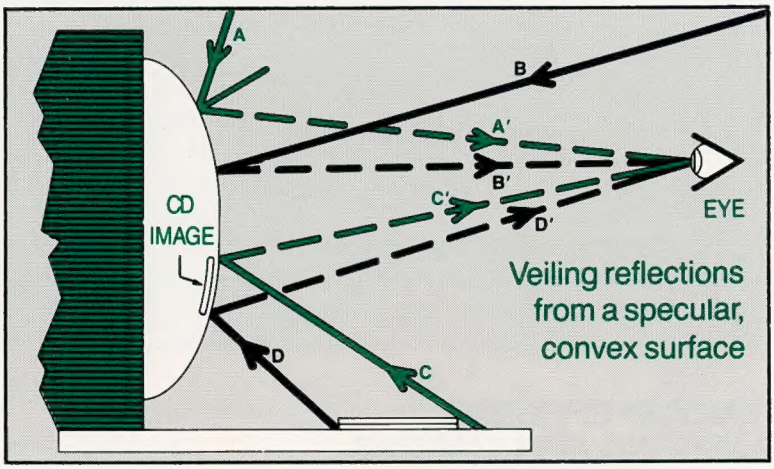
Color is subjective in the sense that people have color preferences and see colors in different ways. The suitability of a lighting system is, therefore, a matter of choice.

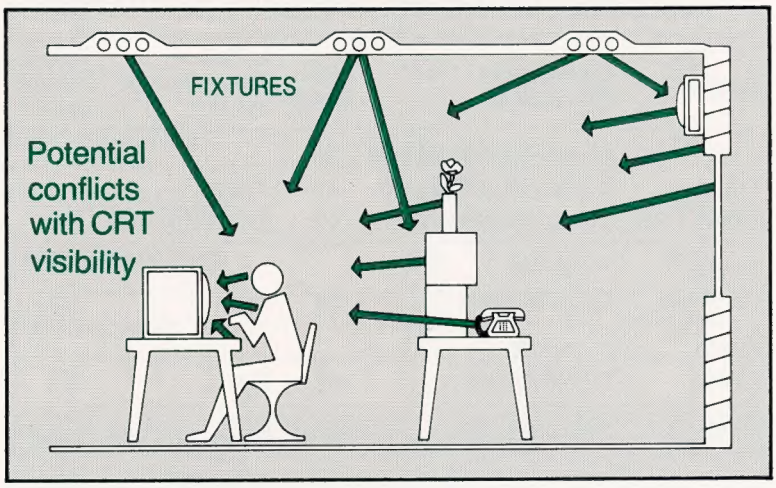
As a general rule of thumb, however, use GE Specification Series lamps which offer a balance in good color and convert electrical energy into a high LPW light source offering value to the user at a minimal initial cost premium.

| STANDARD | *Change to* | SP |
|---|---|---|
| Cool White, Lite White | | SP41 |
| White | | SP35 |
| Warm White | | SP30 |

# SPECIAL APPLICATIONS

## CRT DISPLAYS




### LIGHT LEVEL RECOMMENDATIONS

| | |
|---|---|
| No hard copy (telephone interface to CRT operator) | 30 FC |
| Medium copy (copy to CRT input) | 50-100 FC |
| Fine, detailed copy (fine print copy to CRT input) | 100 FC |

Problem:

### GLARE

***How to control brightness:***

- ☐ Darken walls
- ☐ Darken surfaces (drapes, blinds as well as desk tops)
- ☐ Place fixtures over both shoulders
- ☐ Use good shielding fixtures (parabolic louvers, parabolic wedge)

# INDUSTRIAL

## LIGHT LEVEL RECOMMENDATIONS

| | |
|---|---|
| Loading Platforms | 20 FC |
| Shipping and Receiving | 30 FC |
| Warehouse | |
| ☐ Active — large labels/small labels | 15 FC/30 FC |
| ☐ Inactive | 5 FC |
| Machine Shop | |
| ☐ Rough bench (threading pipe) | 50 FC |
| ☐ Medium bench (assembling cabinets) | 100 FC |
| ☐ Fine bench (electronic assembly) | 300 FC |

## ENERGY-EFFICIENT LIGHTING APPLICATIONS

### FLUORESCENT AND HIGH INTENSITY DISCHARGE

| Specified | Substitute with Fixture Using | Watts Saved | or, Reduce Fixtures Needed by Using | Reduce Fixtures up to* |
|---|---|---|---|---|
| | 4 Lamp F40LW/RS/WM:WM | 39 | | |
| 4 Lamp | 3 Lamp F40LW/MMII:MMII | 41 | 4 Lamp | |
| F40CW Troffer | 4 Lamp Optimiser System | 60 | F40LW/MMII:MMII | 20% |
| 2 Lamp | 2 Lamp F96 | | | |
| F96 Slimline | T12LW/WM:MMII | 36 | N/A | N/A |
| 2 Lamp | 2 Lamp F96 | | | |
| F96/HO | T12LW/HO:MMII | 42 | N/A | N/A |
| HR 100 DX | LU50; LU50 MED | 57 | N/A | N/A |
| | | | LU150/55; | |
| | LU70 or | 115 | MVR250/U* | |
| HR 175 DX | LU100 | 75 | LU250/S | 40-70% |
| | | | LU250/S; | |
| | LU150/55 | 260 | MVR400* | |
| HR 400 DX | MVR250/U* | 155 | LU400 | 40-70% |
| | | | LU1000;MVR1000* Outdoor | |
| HR 1000 DX | LU400 | 610 | MVR1500* Sports Lighting | 40-70% |

*Reduction depends on lamp choice in previous column, fixture efficiency and specific application conditions.

"**WARNING:** This lamp can cause serious skin burn and eye inflammation from shortwave ultraviolet radiation if outer envelope of the lamp is broken or punctured, and the arc tube continues to operate. Do not use where people will remain for more than a few minutes unless adequate shielding or other safety precautions are used. Certain types of lamps that will automatically extinguish when the outer envelope is broken or punctured are commercially available from General Electric Company. These are the self-extinguishing SAF-T-GARD™ Mercury and Multi-Vapor lamps".

## RULES OF THUMB

Fixtures needed for 100 FC over a 10,000 sq. ft. area:

| Lamp Code | No. of Fixtures | Watts/Fixture |
|---|---|---|
| HR 1000DX36-15 | 49 | 1080 |
| HR 400DX33-1 | 153 | 455 |
| LU400 | 44 | 485 |
| LU250 | 79 | 315 |
| MVR 400/VBU | 61 | 460 |
| LU150 | 136 | 200 |
| MVR250/U | 104 | 290 |
| MVR175/U | 159 | 210 |
| 500-120v | 152 | 500 |
| F48PG17/CW (2) | 83 | 450 |
| F96T12CW/1500 (2) | 93 | 420 |
| F96T12CW/HO (2) | 119 | 253 |
| F96T12CW(2) | 168 | 172 |

**EXAMPLE:**
How many MVR 400/VBU fixtures needed for 80 FC over 25,000 sq. ft.?

$$61 \times .8 \times 2.5 = 122 \text{ fixtures needed}$$

$$\text{Footcandles} = \frac{\text{Total lamp lumens per fixture}}{2 \times \text{Area per fixture}}$$

**EXAMPLE:**
What spacing would be required to obtain 100 FC using LU400 fixtures?

$$100 = \frac{50{,}000}{2 \times A}$$

$$A = \frac{50{,}000}{200} = 250 \text{ sq. ft.}$$

or 15′ x 15′ centers*

* Check fixture spacing to mounting height ratio

# AREA

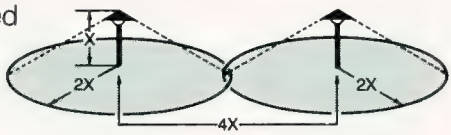
## LIGHT LEVEL RECOMMENDATIONS

| | |
|---|---|
| Storage Yards | |
| ☐ Active/Inactive | 20 FC/1 FC |
| Parking Areas | |
| ☐ Open — high activity/medium activity | 2 FC/1 FC |
| ☐ Covered — parking, pedestrian areas | 5 FC |

## PARKING LOT DESIGN

☐ For uniform lighting, poles should not be spaced more than 4 times the height of the pole, between poles.

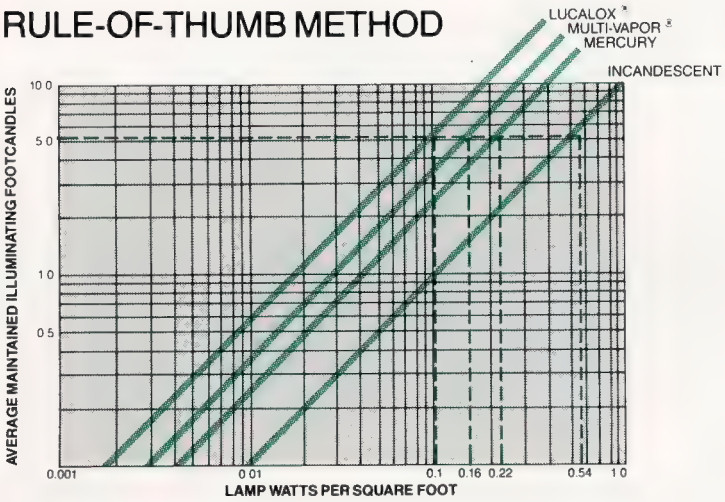
☐ Pole height is determined by the number of poles needed and the area to be lighted.




☐ Streetlighting type fixtures are best used where poles are mounted within the interior of the parking lot.

☐ Floodlighting type fixtures are best used where poles are mounted outside the area to be lighted.

## RULE-OF-THUMB METHOD




1. Determine recommended footcandle level from the table above.
2. Locate the desired footcandle level on the left side of the graph and read across until you intersect the dark diagonal line representing your light source choice. Refer to the dashed-line example for five footcandles.
3. Read straight down the bottom scale of the graph to determine the watts/ft. factor. See dashed-line examples: Lucalox = 0.1 watt/ft., Multi-Vapor = 0.16, Mercury = 0.22 and incandescent = 0.54.
4. Multiply the watts/ft. by the total square footage of the area to obtain the total watts needed to light the area.
5. Divide the total watts by the desired lamp watts to obtain the total number of lamps and luminaires required.

# STORE

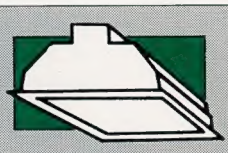
## LIGHT LEVEL RECOMMENDATIONS

| | Circulation | Merchandising | Feature Displays |
|---|---|---|---|
| High Activity Area (Mass Merchandiser) | 30 | 100 | 500 |
| Medium (Family Dept. Store) | 20 | 70 | 300 |
| Low (Boutique, Jewelry Store) | 10 | 30 | 150 |

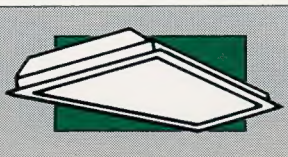
## GENERAL LIGHTING

Watts-per-square-foot Comparison for
100 Footcandle General Lighting Systems.

| | |
|---|---|
| 300M/IF | 8.6 |
| HR400DX | 5.1 |
| MXR175/BU | 2.3 |
| MVR250/C/U | 2.9 |
| LU250/DX | 2.5 |



| | |
|---|---|
| 300M/IF | 10.7 |
| MXR175/C/BU | 2.3 |
| MVR250 | 2.9 |
| HR400/WDX | 6.6 |
| LU250/DX | 2.5 |



| | |
|---|---|
| (4)F40/CW (4)F40/WW | 3.9 |
| (4)F40/WWX (4)F40/CWX | 6.1 |
| (4)F40SP30/RS/WM | 3.5 |
| (4)F40SP35/RS/WM | 3.6 |
| (4)F40LW/RS/WMII | 3.5 |

| | |
|---|---|
| (2)F96CW/WW | 2.9 |
| (2)F96CWX/WDX | 4.3 |
| (2)F96RW3 | 3.5 |
| (2)F96RW3/WW | 3.6 |
| (2)F96LW/WM | 2.6 |

# ACCENT LIGHTING GUIDE

| Type | Lamp Code | Spread (Feet) | Maximum Footcandles |
|---|---|---|---|
| R | 150R/SP | 8.3 | 42 |
| | 150R/FL | 32 | 12 |
| ER | 75ER30 | 14 | 12 |
| | 120ER30 | 17 | 17 |
| PAR | 90PAR/SP/WMII | 4.6 | 90 |
| | 90PAR/FL/WMII | 8.5 | 30 |
| | 150PAR/SP/120WM | 4.8 | 97 |
| | 150PAR/FL/120WM | 9.3 | 34 |
| | Q150PAR38/SP | 2.8 | 205 |
| Precise | Q20MR16/NSP | 2.6 | 33 |
| | Q20MR16/FL | 7.7 | 5 |
| | Q50MR16/SP | 2.6 | 92 |
| | Q50MR16/NFL | 6.7 x 6.1 | 30 |
| | Q50MR16/FL | 7.3 | 15 |
| | Q75MR16/NSP | 2.8 | 115 |
| | Q75MR16/FL | 8.3 | 20 |
| PAR 36 | 50PAR36VNSP | 1.6 x .9 | 200 |
| | 50PAR36NSP | 4.2 x 2.8 | 74 |
| | 50PARWFL | 9.3 x 8.1 | 11 |
| PAR 56 | 120PAR56VNSP | 1.7 x 1.0 | 485 |
| | 120PAR56MFL | 7.9 x 2.1 | 130 |

LIGHTING BUSINESS GROUP

GENERAL ELECTRIC

205-51514